REMARKS

Claims 1, 4-12, and 17-19 are pending in this application.

Applicant has amended claims 1, 8, and 17-19 to clarify that the carbon separator is formed from a "gas-impermeable dense" carbon. Support for these amendments may be found on page 14 of the originally filed specification.

Claims 8-12, 18, and 19 stand rejected under 35 U.S.C. § 103(a) as unpatentable over JP 7-249417 in view of U.S. Patent No. 5,284,718 to Chow et al. in view of U.S. Patent No. 6,044,842 to Pereira et al. Claims 1, 4-7, and 17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over JP 7-249417 in view of Chow et al. and Pereira et al. as applied to claims 8-12, 18 and 19 above, and further in view of U.S. Patent No. 4,804,451 to Palmer.

Applicant traverses the pending rejections for the following reasons.

The present invention provides a fuel cell and a method of manufacturing a fuel cell, including a polymer electrolyte film, a gas-impermeable dense carbon separator, and an adhesive. The adhesive has at least one specific property, including, a durometer A hardness of not greater than 90 after cure and/or a modulus of elasticity of not greater than 10 MPa after cure. Furthermore, the polymer electrolyte film has a water content of not greater than 4, which is expressed as a molar fraction of H_2O.

In rejecting the pending claims, the Examiner cites JP 7-249417 as teaching a fuel cell, including a membrane bonded to a support frame with adhesive. However, JP 7-24917 does not teach or suggest a gas-impermeable dense carbon separator. As the Examiner indicates, the support frame, which may act as a separator, is formed from resins (for example, phenol resin, PPS, a polyamide, etc.), none of which are formed from gas-impermeable dense carbon. Applicant submits that the resins may include carbon in a polymer form, but they do not meet the recited claim limitation.

Nor does JP 7-249417 teach or suggest an adhesive having a modulus of elasticity of not greater than 10 MPa after cure or a durometer A hardness of not greater than 90 after cure. JP 7-249417 also does not teach or suggest the polymer electrolyte film has a water content of not greater than 4, which is expressed as a molar fraction of H_2O.

To correct these missing properties, Chow et al., Perira et al., and Palmer are cited by the Examiner. Specifically, Chow et al. is cited as teaching the need for resilient sealing materials and Perira et al. is cited as teaching a resilient material and the relationship between elastic modulus and durometer A hardness. The Examiner further cites Palmer as teaching that when membranes are bonded to frames with an adhesive, the bonds are weak because the membrane surfaces are wet. In view of these additional teachings, the Examiner indicates that the invention as a whole would have been obvious to one of ordinary skill in the art in view of these references.

Applicant disagrees. None of the cited references teach or suggest a polymer electrolyte film being fixed to a gas-impermeable dense carbon separator, therefore, there is no reason why one of ordinary skill in the art would have combined the cited references to achieve the claimed method.

In addition, Applicant submits that the Examiner used improper hindsight to identify and combine the cited references. One of ordinary skill in the art would not have been motivated to combine the very specific identified teachings in the secondary references to achieve an adhesive or a polymer electrolyte film with the claimed properties without first reviewing Applicant's own specification.

Furthermore, even if each of the secondary references teaches what the Examiner alleges, there is no suggestion or motivation within the references as to why one of ordinary

skill in the art would combine the teaching of a fuel cell assembly with that of a gasketless connecting adapter or electrodialysis to achieve the claimed invention.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that the presently pending claims are in condition for allowance and issuance of a Notice of Allowance for claims 1, 4-12 and 17-19 is respectfully requested.

The Examiner is invited to contact the undersigned to discuss any matter concerning this application.

The Office is authorized to charge any underpayment or credit any overpayment to Kenyon & Kenyon Deposit Account No. 11-0600.

Respectfully submitted,

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Version With Markings to Show Changes Made

1. (Three Times amended) A method of manufacturing a fuel cell comprising a layer stack of unit cells each including a polymer electrolyte film and gas diffusion electrodes, [by fixing a polymer electrolyte film to a carbon separator,] said method comprising the steps of:

fixing a polymer electrolyte film to a gas-impermeable dense carbon separator, wherein a gas flow path is formed with the surface of each unit cell;

causing the polymer electrolyte film to have a water content of not greater than 4, which is expressed as a molar fraction of H_2O; and

bonding the polymer electrolyte film to the carbon separator with an adhesive having a modulus of elasticity of not greater than 10 MPa after cure.

8. (Twice Amended) A method of manufacturing a fuel cell by fixing a polymer electrolyte film to a gas-impermeable dense carbon separator, said method comprising the steps of:

providing an adhesive having a modulus of elasticity of not greater than 10 MPa after cure; and

bonding the polymer electrolyte film to the carbon separator with the adhesive.

17. (Twice amended) A fuel cell, comprising:

a gas-impermeable dense carbon separator; and

a polymer electrolyte film that has a water content of not greater than 4, which is expressed as a molar fraction of H_2O, and is bonded to the carbon separator with an adhesive having a modulus of elasticity of not greater than 10 MPa after cure.

18. (Twice Amended) A fuel cell, comprising:

a polymer electrolyte film;

a gas-impermeable dense carbon separator; and

an adhesive that is used to bond the polymer electrolyte film to the carbon separator and has a modulus of elasticity of not greater than 10 MPa after cure.

19. (Twice Amended) A fuel cell, comprising:

a polymer electrolyte film;

a gas-impermeable dense carbon separator; and

an adhesive that is used to bond the polymer electrolyte film to the carbon separator and has a durometer A hardness of not greater than 90 after cure.